

Having described the invention, what is claimed is:

1 **CLAIM 1.**

2 A process for depositing a film onto a bare or unplated zinc or zinc alloy  
3 substrate, the process comprising:

4 directly depositing a film onto a portion of the substrate by physical vapor  
5 deposition, the film being a metal film, a ceramic film or a combination thereof,

6 wherein the metal film includes chromium, nickel, titanium, zirconium or a  
7 combination thereof, and wherein the ceramic film includes a nitride, a carbide,  
8 an oxide or a nitroxide of chromium, nickel, titanium, zirconium, or a combination  
9 thereof.

1 **CLAIM 2.**

2 The process of Claim 1 wherein the film is a metal film and the metal film in-  
3 cludes chromium, nickel or a combination thereof.

1 **CLAIM 3.**

2 The process of Claim 2 wherein the metal film is deposited at a maximum in-  
3 ternal reactor pressure of about  $5 \times 10^{-2}$  torr using a DC voltage ranging from about 25  
4 Volts to about 600 Volts and at deposition rates of about 200 Angstroms to more  
5 than 1,000 Angstroms per minute to obtain film thicknesses ranging from about 1000  
6 Angstroms to about 20,000 Angstroms.

**CLAIM 4.**

The process of Claim 2, wherein the metal film is deposited at a maximum internal reactor pressure of about  $5 \times 10^{-2}$  Torr using a DC voltage ranging from about 40 Volts to about 200 Volts at deposition rates of about 400 Angstroms to more than 500 Angstroms per minute to obtain film thicknesses ranging from about 2,500 Angstroms to about 9,000 Angstroms.

**CLAIM 5.**

The process of Claim 1 wherein the film is a ceramic film and the ceramic film includes a nitride, a carbide, an oxide or a nitroxide of titanium or zirconium.

**CLAIM 6.**

The process of Claim 5 wherein the ceramic film is deposited at a maximum internal reactor pressure of about  $5 \times 10^{-2}$  torr using a DC voltage ranging from about 25 Volts to about 600 Volts and at deposition rates of about 200 Angstroms to more than 1,000 Angstroms per minute to obtain film thicknesses ranging from about 1000 Angstroms to about 20,000 Angstroms.

1   **CLAIM 7.**

2           The process of Claim 5, wherein the ceramic film is deposited at a maximum  
3   internal reactor pressure of about  $5 \times 10^{-2}$  Torr using a DC voltage ranging from about  
4   40 Volts to about 200 Volts at deposition rates of about 400 Angstroms to more than  
5   500 Angstroms per minute to obtain film thicknesses ranging from about 2,500 Ang-  
6   stroms to about 9,000 Angstrom.

1   **CLAIM 8.**

2           The process of Claim 1 wherein the film is a ceramic film including a nitride, a  
3   carbide, an oxide or a nitroxide of titanium.

1   **CLAIM 9.**

2           The process of Claim 1 wherein the film is a ceramic film including a nitride, a  
3   carbide, an oxide or a nitroxide of zirconium.

1   **CLAIM 10.**

2           The process of Claim 1 wherein the film is a ceramic film including a nitride, a  
3   carbide, an oxide or a nitroxide of both titanium and zirconium.

1   **CLAIM 11.**

2           The process of Claim 1 wherein the film is a ceramic film including a nitride of  
3   chromium, nickel, titanium or zirconium.

1   **CLAIM 12**

2           The process of Claim 1 wherein the film is a ceramic film including a carbide  
3   of chromium, nickel, titanium or zirconium.

1   **CLAIM 13.**

2           The process of Claim 1 wherein the film is a ceramic film including a nitroxide  
3   of chromium, nickel, titanium or zirconium .

1   **CLAIM 14.**

2           The process of Claim 1 wherein the film is a metal film including chromium.

1   **CLAIM 15.**

2           The process of Claim 1 wherein the film is a metal film including nickel.

1   **CLAIM 16.**

2           The process of Claim 1 wherein the ceramic film has a thickness of from  
3   about 1,500 Angstroms to about 20,000 Angstroms.